

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION**

HEARING CHARTER

Beyond the Classroom: Informal STEM Education

**Thursday, February 26, 2009
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building**

1. Purpose

The purpose of the hearing is to examine the role of informal environments in promoting STEM learning. The Subcommittee will explore the potential for informal STEM learning to engage students in math and science in ways that traditional formal learning environments cannot, as well as the ways in which informal STEM education can complement and enhance classroom STEM studies. Furthermore, we will receive testimony on the National Academies report, “Learning Science in Informal Environments: People, Places, and Pursuits.”

2. Witnesses:

- **Dr. Joan Ferrini-Mundy**, Division Director, Division of Research on Learning in Formal and Informal Settings, Education and Human Resources Directorate, National Science Foundation.
- **Dr. Phillip Bell**, Co-Chair, National Academies report “Learning Science in Informal Environments: People, Places, and Pursuits,” and Professor, College of Education, the University of Washington, Seattle.
- **Ms. Andrea Ingram**, Vice President of Education and Guest Experiences, Museum of Science and Industry-Chicago.
- **Mr. Robert Lippincott**, Senior Vice President for Education, the Public Broadcasting Service (PBS).
- **Dr. Alejandro Grajal**, Senior Vice President of Conservation, Education, and Training, the Chicago Zoological Society.

3. Overarching Questions:

- What is the role of informal environments in educating students and the public about Science, Technology, Engineering and Mathematics (STEM)? In what ways can informal education contribute to and enhance classroom learning? Are there areas that informal environments are uniquely positioned to address? What role can informal education play in broadening participation and promoting diversity in STEM fields?
- What are the key factors in successful partnerships between informal science organizations and formal education institutions, including both K-12 and higher education? What opportunities for partnerships exist with the private sector? How have both museums and educational media providers had to adapt to meet the needs of schools and States? How can K-12 schools and institutions of higher education take advantage of informal learning environments to meet their needs?
- What kind of research is being done on informal science education to assess its evolving role and effectiveness? What metrics exist to assess and evaluate informal learning environments, and what are the barriers to developing better metrics? What are some of the major challenges and opportunities that lie ahead in the field of informal science learning?
- What support could federal research agencies provide to most effectively contribute to the development and implementation of informal STEM education activities?

4. Background

There is now a consensus that improving science, technology, engineering, and mathematics education is critical to the Nation's economic strength and global competitiveness in the 21st century. Reports have emphasized the need to attract and educate the next generation of American scientists and innovators. For example, the National Academies' 2005 report, *Rising Above the Gathering Storm*, recommends that the Nation increase its talent pool by vastly improving K-12 science and mathematics education. This recommendation was embraced by the America COMPETES Act which was developed by the Science & Technology Committee in the last Congress and was signed into law in August, 2007. Many in the STEM educator community have argued that in order to improve STEM education, we must draw on a full range of learning opportunities and experiences, including those in informal, non-school settings. Reports by both the National Science Board¹ and the Academic Competitiveness Council² cited informal education as an integral component of our Nation's education system.

Informal Education

Informal science education can take place in a variety of places and through a wide variety of media such as science centers and museums, film and broadcast media,

¹ National Science Board (2007). Science, technology, engineering, and mathematics (STEM) education issues and legislative options. In R. Nata (Ed.), *Progress in education* (Vol. 14, pp. 161-189).

² U.S. Department of Education (2007). *Report of the Academic Competitiveness Council*. Washington, DC: Author.

aquariums, zoos, nature centers, botanical gardens, online games, and after-school programs. It is widely held that informal learning can happen in everyday environments and through everyday activities as well. While it can be difficult to define informal education, the term tends to broadly refer to any opportunities for learning that take place in non-traditional, non-school settings.

National Academies Report on Informal Science Learning

The Committee on Learning Science in Informal Environments was established by the National Research Council (NRC) of the National Academies to undertake a study of the status of, and potential for science learning in informal environments. The National Science Foundation (NSF), a principal sponsor of research in informal science education, provided support for the study. In January 2009 the National Academies Committee released a report entitled “Learning Science in Informal Environments: People Places, and Pursuits,” summarizing the key conclusions of the study and providing recommendations for future research and practice. The Committee found, among other things, that there is ample evidence to suggest that science learning takes place throughout the life span and across venues in non-school settings. The Committee outlined and examined four categories where informal learning often takes place: everyday experiences, designed spaces (such as museums, science centers and zoos), non-school educational programs, and science media. The report summarizes the conclusions drawn from the research reviewed by the Committee, and offers recommendations for practice and research to exhibit and program designers, front-line educators, researchers and evaluators.

A key issue addressed in the report is the need to effectively evaluate and assess informal STEM education. Assessing learning in non-school settings can prove difficult since informal settings for STEM learning typically do not include tests or grades. Yet, there tends to be a general agreement that it is important to evaluate learning outcomes in order to improve informal STEM programs and activities. Another key issue highlighted in the report is the role of informal STEM education in promoting diversity and broadening participation. The committee found that informal environments can have a significant impact on STEM learning outcomes in historically underrepresented groups, and informal learning environments may be uniquely positioned to make STEM education accessible to all.

5. Federal Support for Informal STEM Education

Informal STEM Education Support at NSF

STEM education research and development activities are funded out of a number of federal agencies, with NSF being the primary source of support for STEM education research. Historically, NSF’s mission has included supporting and strengthening the Nation’s STEM research and education activities at all levels. NSF carries out this mission by funding STEM activities ranging from teacher training and curriculum development to informal education and research on learning.

Many of the Foundation's STEM education and research activities are housed in the Directorate for Education and Human Resources (EHR). EHR support for research on learning and STEM education is largely funded through its Division on Research Learning in Formal and Informal Settings (DRL). The FY08 budget for DRL was approximately \$209 million. One of the chief informal STEM education programs funded through DRL is the Informal Science Education (ISE) program. ISE invests in projects that are designed to increase interest and understanding of STEM through informal learning experiences, with a particular emphasis on projects that seek to inform and strengthen informal STEM education nationally, and have the potential to make a strategic impact on the field as a whole. The FY08 budget for ISE was approximately \$66.0 million.

While the majority of the Foundation's STEM education support comes out of EHR, there are a variety of STEM activities being funded across the research directorates. One such example, the Centers for Ocean Sciences Education Excellence (COSEE) program, housed in the Geosciences Directorate in the Division of Ocean Sciences (GEO/OCE), has a strong informal education component. The COSEE program invests in projects that connect scientists with educators in formal settings as well informal settings such as museums and aquariums. Another example is the International Polar Year (IPY) awards in NSF's Office of Polar Programs (OPP). Such awards fund formal and informal interdisciplinary projects aimed at educating the public about the polar regions. IPY projects have ranged from museum support and teacher development programs to film projects documenting polar marine ecosystems in Antarctica.

Support for Informal STEM Education at Other Agencies

The other mission agencies within the jurisdiction of the House Science & Technology Committee also support STEM education, including informal STEM education, through a variety of mechanisms. While it is not possible to provide budget information regarding all the informal science education initiatives at the agencies at present, there are a few notable programs that serve as examples of agency support of informal STEM education. The National Aeronautics and Space Administration (NASA) Informal Education Division has recently initiated its NASA Explorer Institute (NEI) program, designed to bring together members of the informal education community and NASA staff to facilitate discussions on how to best utilize NASA missions to educate students and the public about STEM. NEI supports the informal science education community by providing NASA-related professional development opportunities, STEM teaching tools and other development projects for informal STEM educators at NASA field centers. Another NASA activity, the NASA e-Education programs, develop research-based products and services specifically designed to enhance both formal and informal education. At the National Oceanic and Atmospheric Administration (NOAA), the new NOAA Education competitive grant program funds projects that bring together formal and informal education institutions to create projects that promote environmental literacy and build public understanding of our global system and the interconnectivity of oceanic and atmospheric processes.

It is difficult to identify all the informal education programs since a comprehensive database of STEM education programs within the federal agencies does not exist at present. Many STEM education initiatives are clearly identified within their respective education offices and budget lines, but many other important STEM activities embedded within other agency mission directorates or program offices are much harder to identify. For that reason, Committee staff has undertaken the task of creating a comprehensive database of STEM education programs and activities within the six mission agencies under Science & Technology Committee jurisdiction.

6. Questions for Witnesses

Dr. Ferrini-Mundy

- What is the current level of support and the scope of NSF-funded research on informal STEM education? How much of NSF's research support in this area is directed to academic researchers and how much to providers of informal science education, or consortia thereof?
- What metrics and methodologies exist for evaluation and assessment of informal education environments? What are the barriers to developing better metrics? What is or should be NSF's role in developing those metrics?
- How can informal STEM education environments help NSF achieve its mission to broaden participation in STEM? To what extent are informal learning environments incorporated into programs to broaden participation managed elsewhere in the Education and Human Resources Directorate or throughout the Foundation? How do you communicate relevant new findings supported by your division to colleagues who manage those programs?

Dr. Bell

- Please summarize the findings and recommendations of the National Academy of Sciences report, "Learning Science in Informal Environments: People, Places and Pursuits."
- What do we know about how students and the general public learn in informal environments? What don't we know? How can we effectively evaluate informal learning environments? Is the current level of support for research in these areas adequate?
- Please provide an overview of your own groups' research on informal education at the NSF-funded Learning in Informal and Formal Environments (LIFE) Center at the University of Washington.

Ms. Ingram and Dr. Grajal

- What is the role of informal learning environments, such as [museums/zoos], in educating students and the public about Science, Technology, Engineering and Mathematics (STEM)? In what ways can institutions such as [museums/zoos] contribute to and enhance classroom learning? In what ways can and have informal

STEM education institutions, such as [museums/zoos], provided professional development for teachers?

- What role can informal education play in broadening participation and promoting diversity in STEM fields? What are informal education institutions, such as the [museum/zoo], doing to engage and educate diverse populations?
- Please describe any partnerships the [museum/zoo] may have with formal education institutions, including both K-12 and higher education. What have been the key factors to the success of such partnerships? How have informal STEM education institutions such as [museums/zoos] had to adapt to meet the needs of schools and States?

Mr. Lippincott

- What role can digital and electronic media play in educating students and the public about Science, Technology, Engineering and Mathematics (STEM) in the 21st century? In what ways can media be used as a teaching tool in the classroom? In what ways can and have educational media providers, such as PBS, provided professional development for teachers?
- What role can informal education play in broadening participation and promoting diversity in STEM fields? What are media providers, such as PBS, doing to engage and educate diverse populations?
- Please describe any partnerships PBS may have with formal education institutions, including both K-12 and higher education. What have been the key factors in the success of such partnerships? How have media providers had to adapt to meet the needs of schools and States?